Aug. 19, 1941. D. G. SMELLIE 2,253,309

SUCTION CLEANER

Filed Jan. 7, 1938 5 Sheets-Sheet 1

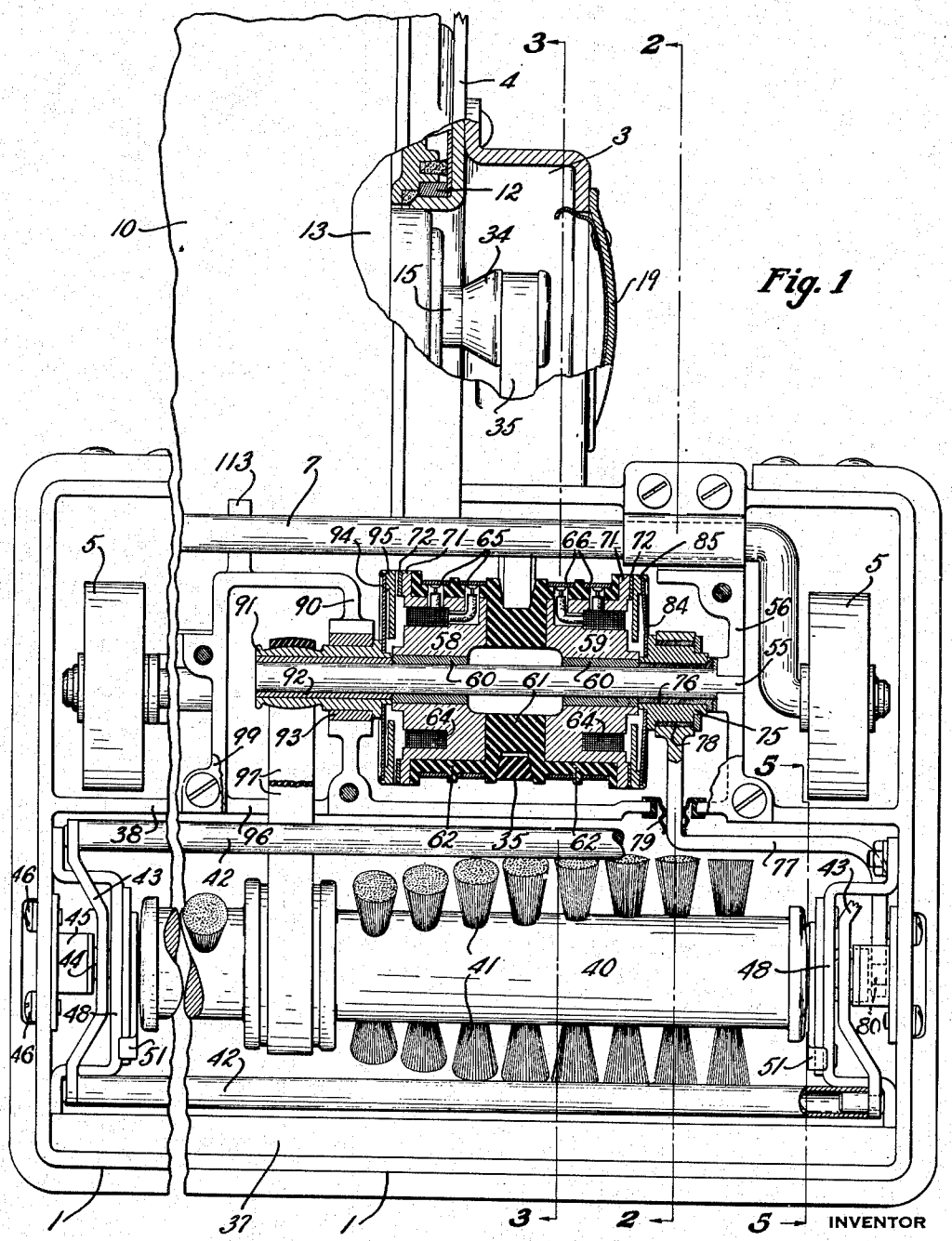


Fig. 1

INVENTOR

Donald G. Smellie

BY Harry S. Demarest

ATTORNEY

Aug. 19, 1941. D. G. SMELLIE 2,253,309

SUCTION CLEANER

Filed Jan. 7, 1938 5 Sheets-Sheet 2

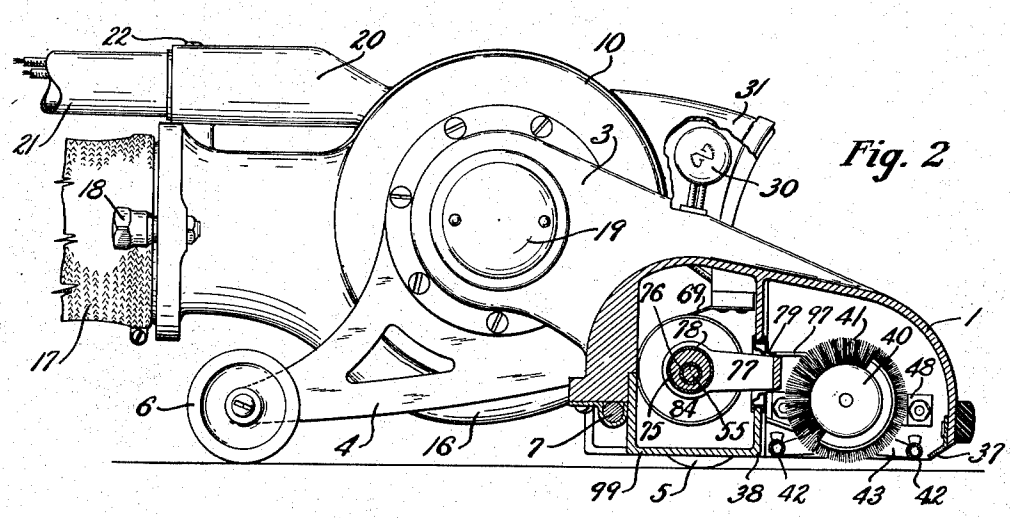


Fig. 2

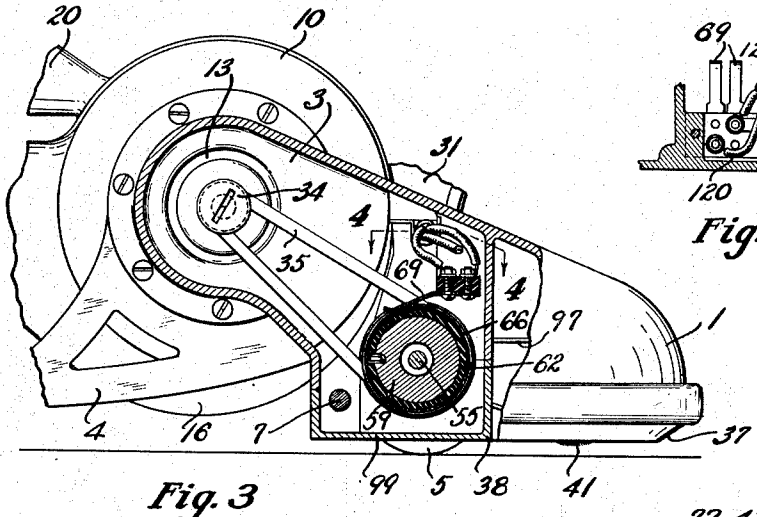


Fig. 3

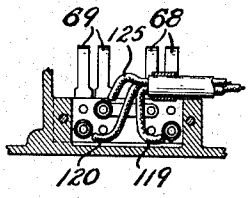


Fig. 4

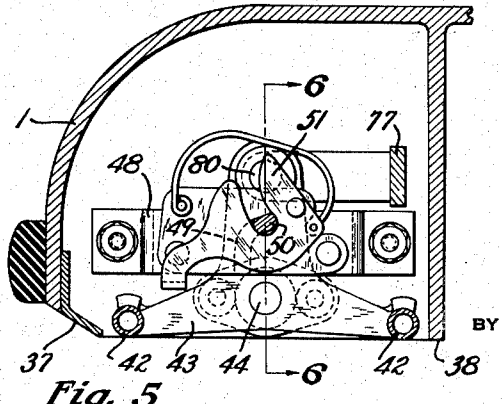


Fig. 5

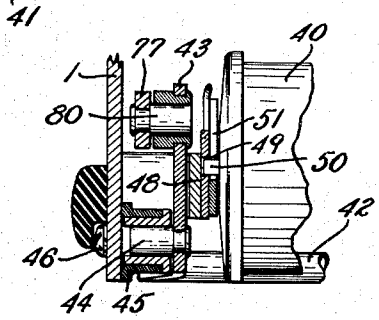


Fig. 6

INVENTOR

Donald G. Smellie

BY

Harry E. Dunn

ATTORNEY

Aug. 19, 1941. D. G. SMELLIE 2,253,309

SUCTION CLEANER

Filed Jan. 7, 1938 5 Sheets-Sheet 3

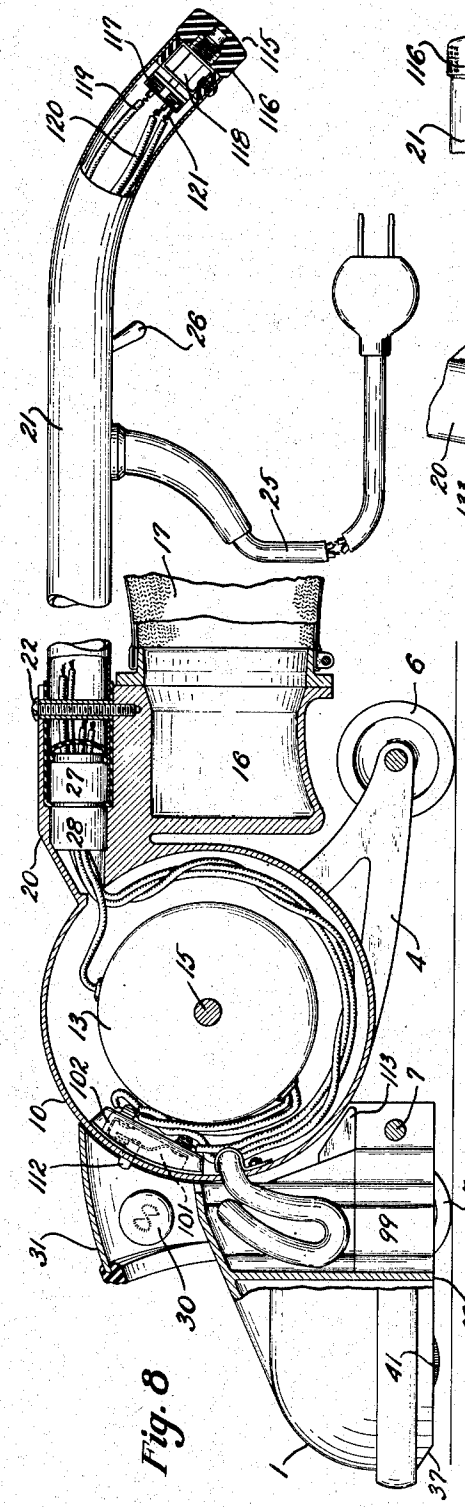


Fig. 8

Fig. 10

Fig. 7

Fig. 9

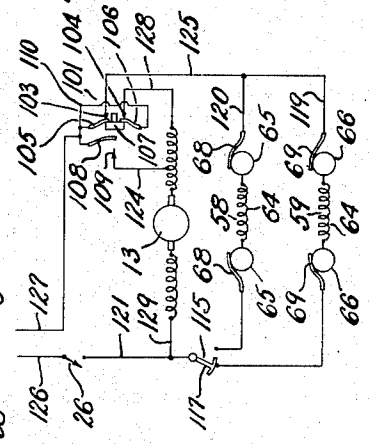


Fig. 11

INVENTOR

Donald G. Smellie

BY

Harry S. Durarse

ATTORNEY

Aug. 19, 1941. D. G. SMELLIE 2,253,309

SUCTION CLEANER

Filed Jan. 7, 1938 5 Sheets-Sheet 4

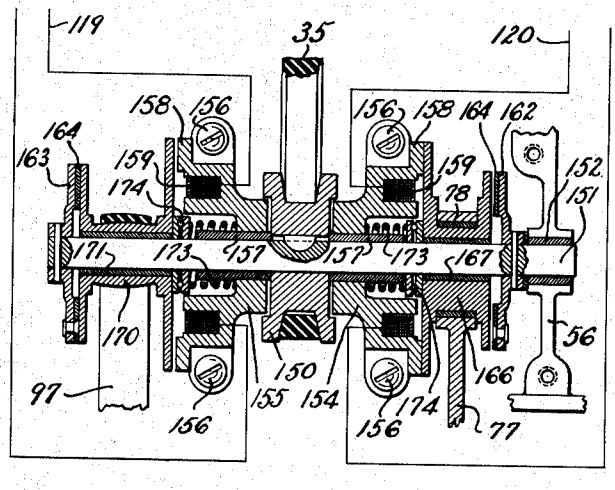


Fig. 12

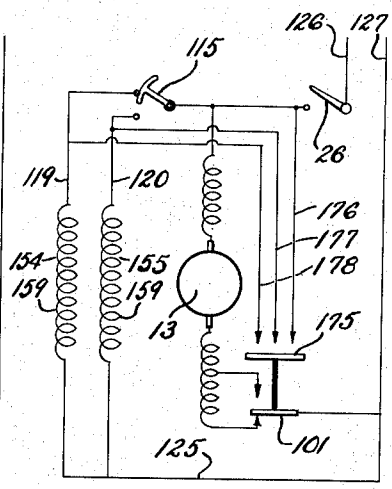


Fig. 13

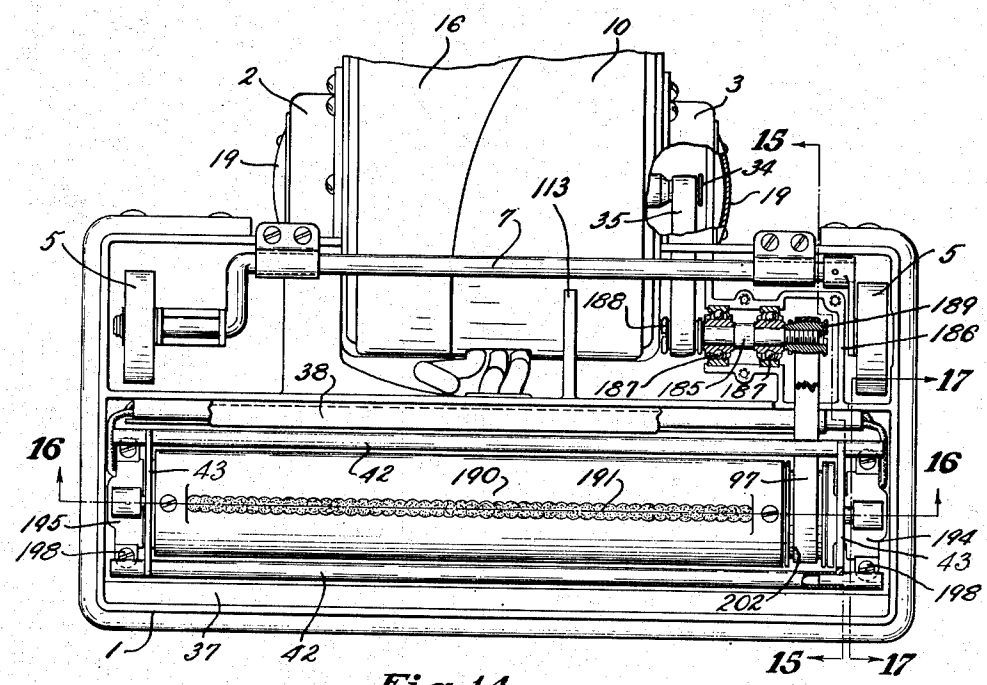


Fig. 14

INVENTOR

Donald G. Smellie

BY

Harry S. Ducasse

ATTORNEY

Aug. 19, 1941. D. G. SMELLIE 2,253,309

SUCTION CLEANER

Filed Jan. 7, 1938 5 Sheets-Sheet 5

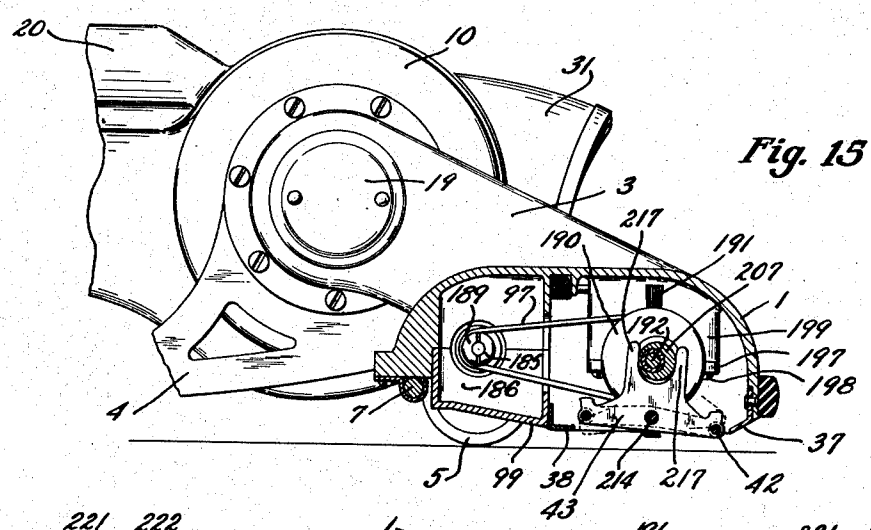


Fig. 15

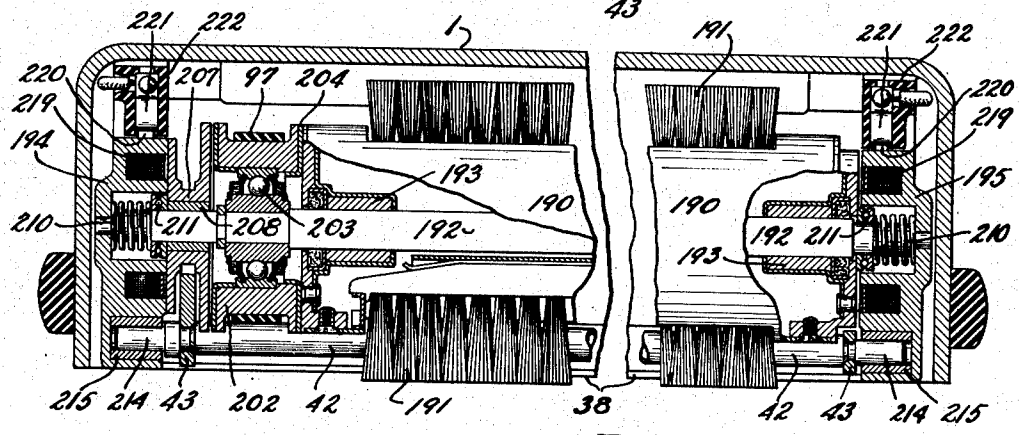


Fig. 16

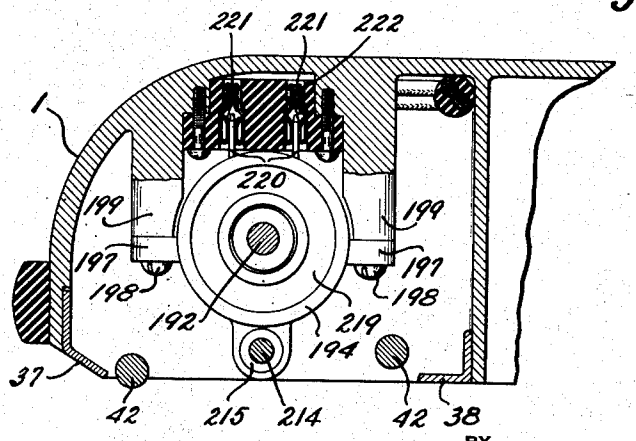


Fig. 17

INVENTOR

Donald G. Smellie

BY

Harry S. Duncan

ATTORNEY

Patented Aug. 19, 1941

2,253,309

UNITED STATES PATENT OFFICE

2,253,309

SUCTION CLEANER

Donald G. Smellie, Canton, Ohio, assignor to The Hoover Company, North Canton, Ohio, a corporation of Ohio

Application January 7, 1938, Serial No. 183,741

14 Claims. (Cl. 15—6)

The present invention relates to suction cleaners in general and particularly to new and novel agitating means and the controls therefor in a suction cleaner. More specifically the invention comprises a suction cleaner which embodies brushing and beating means which are selectively controlled by the operator in order that the cleaner may function as an air cleaner without agitating means, as a cleaner embodying brushing means, as a cleaner embodying beating means, or as a cleaner embodying both brushing and beating means.

It is an object of the present invention to provide a new and improved suction cleaner. It is another object of the invention to provide a suction cleaner incorporating new agitating control means. Still another object of the invention is to provide a suction cleaner in which brushing and beating means are selectively controlled by the cleaner operator. Still another object of the invention is to provide a suction cleaner which can function as a straight air cleaner, as a cleaner embodying brushing means, or beating means, or brushing and beating means combined. A still further object of the invention is to provide new and novel control means for the agitating means in a suction cleaner. A further object of the invention is to provide new and novel disconnecting means between the driving power source and the agitating means in a suction cleaner. These and other more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawings to which they relate.

Referring now to the drawings in which preferred embodiments of the invention are disclosed and in which the same reference character refers to the same parts throughout:

Figure 1 is a bottom view of the cleaner embodying the present invention with certain parts broken away and the electrically operated clutches shown in section;

Figure 2 is a view looking in the direction of the arrows upon the line 2—2 in Figure 1 and shows the cleaner in side elevation with a vertical section through the nozzle;

Figure 3 is a section through the agitator power-transmission means upon the line 3—3 of Figure 1;

Figure 4 is a detail showing the wiper contacts by which the current is transmitted to the rotating clutch magnet of the first embodiment of the invention;

Figure 5 is a section upon the line 5—5 of Figure 1 and discloses the rotary brush supporting means;

Figure 6 is a partial longitudinal section through the supporting means for the rotary brush and reciprocating beater element upon the line 6—6 of Figure 5;

Figure 7 is a side elevation of the cleaner with the handle in the vertical position, with the dusting tool attached, and with a portion of the casing broken away to show the automatic control means by which the motor speed is increased;

Figure 8 is a transverse vertical section through the cleaner with the handle in the horizontal position;

Figure 9 is an isometric view of the handle-position-controlled switch;

Figure 10 discloses the extreme end of the handle with the markings upon the rotatable agitator control switch;

Figure 11 is a diagrammatic showing of the electrical circuit of the first embodiment;

Figure 12 is a section through a second preferred embodiment of the magnetic clutches for the agitating means, being a showing similar to that found in Figure 1 for the first embodiment;

Figure 13 is a diagrammatic view of the electrical circuit of this second embodiment;

Figure 14 is a bottom view of a cleaner embodying a third form of the present invention in which the magnetic clutch means are positioned within the cleaner nozzle;

Figure 15 is a section through the nozzle casing upon the line 15—15 of Figure 14;

Figure 16 is a longitudinal section through the agitator in the cleaner nozzle upon the line 16—16 of Figure 14;

Figure 17 is a vertical section upon the line 17—17 of Figure 14 and discloses the separable plug by which one of the electrical clutches is connected to a current source in the cleaner.

The modern suction cleaner is adapted to be operated upon all types of surface coverings and under varied conditions. It is adapted for on-the-floor use and for off-the-floor use. In the latter use the suction cleaner proper provides the suction which is effective through dusting tools connected thereto and through which the cleaning air is drawn, the floor cleaning nozzle of the machine proper being inoperative. In the on-the-floor cleaning relationship the air moving power of the cleaner cooperates with the agitating means thereof to effect dirt removal from the surface covering undergoing cleaning. The operator may wish to use only the brushing

means of the cleaner in cases where the surface covering is in fact clean and only a pile straightening effect is desired. Or the operator may desire to use solely the beating means and to render inoperative the brushing means which are relatively ineffective in dislodging the embedded dirt from a surface covering. In the suction cleaner constructed in accordance with the present invention and as hereinafter fully disclosed, the operator can control the machine to obtain any of the relationships desired as set forth.

Referring again to the drawings and to Figures 1 to 11, inclusive, in particular, the first preferred embodiment of the invention is disclosed. The cleaner nozzle 1, together with the rearwardly and upwardly extending passageways 2 and 3 cooperate with rearwardly extending frame members 4, 4 to form an ambulatory chassis which is movably supported by front wheels 5, 5 and by rear wheels 6, 6. The front wheels are themselves positioned upon the offset ends of a crank 7 mounted on the underside of the chassis there being provided a manual adjustment 8 by which the forward end of the machine may be raised and lowered to adjust the height of nozzle.

Rotatably supported between the passageways 2 and 3 in a manner forming no part of the present invention, but which is fully disclosed and claimed in co-pending application Serial No. 709,073, now Patent Number 2,225,621, filed in the name of Chandos Burkhardt, is a motor fan unit comprising a casing 10. Casing 10 is rotatably mounted by suitable bearings at 12 upon the passageways 2 and 3 and is interiorly divided into a motor casing and a fan chamber which house respectively a motor 13 and a fan 14, the latter being carried by the motor shaft 15. An exhaust outlet 16 extends rearwardly from the fan casing portion of casing 10 and between the rear supporting wheels 6, 6 and a dust bag 17 is removably secured to the end thereof by manually operable nuts 18, 18.

A handle socket 20 is formed on the casing 10 immediately above the exhaust outlet 16 and from it extends an elongated handle 21 which is removably secured in place by a transverse screw 22. The incoming current-carrying cord to the cleaner connects to the upper end of the handle, being indicated at 25, adjacent the normal handle switch 26 and the conductors thereof pass through the handle, through the separable plug elements 27 and 28 in the socket 20, and into the casing 10 where they are suitably connected to the electric motor and to the cleaner headlight 30 which is positioned within a headlight casing 31 formed upon the upper surface of the nozzle chassis. The precise electrical interconnections will be hereinafter fully set forth.

The fan chamber portion of casing 10 which houses the suction-creating fan 14 is directly open to the passageway 2 leading into the nozzle and this passageway functions as an air conduit by which air is drawn by the fan from the nozzle, through the fan chamber, and is exhausted from the exhaust outlet 16 into the filter bag 17. At the opposite side of the casing 10 the motor shaft 15 extends into the passageway 3, which is in fact a belt channel, where it is formed as a pulley 34 to which connects a power-transmitting belt 35.

Within the cleaner nozzle 1 and arranged so as to contact the surface covering undergoing cleaning between the front and rear nozzle lips 37 and 38 is positioned a rotary brush 40 including bristles 41. Also between lips 37 and 38 and adjacent brush 40 is the reciprocating agitator comprising rigid elongated beater elements 42, 42 connected at their ends by frame elements 43, 43 one of which is shaped as an inverted T. Frame elements 43, 43 are pivotally mounted each by a pin 44 which it carries and which extends within a bearing seat 45 removably secured upon the inner face of the nozzle end wall by screws 46, 46. The rotary brush 40 is removably mounted within the nozzle between the frame elements 43, 43 at its opposite ends upon U-shaped brackets 48, 48 which are permanently attached to the nozzle end walls. The inner face of each bracket is provided with a downwardly opening slot 49 which receives and seats at its upper curved end the outer end of the agitator-supporting shaft 50, there being a pivoted spring-urged latch 51 which removably clamps the shaft in place in a common and well known manner.

Within the nozzle casing, but outside and to the rear of the nozzle proper, as defined by the nozzle lips 37 and 38 is positioned a stationary shaft 55 one end of which is supported in non-rotating relationship by a supporting wall 56. Upon this shaft 55 are mounted the electrically actuated disconnecting clutches for the agitators within the cleaner nozzle. These clutches include magnets 58 and 59 rotatably supported upon the shaft 55 by sleeve bearings 60, 60 and which are separated from each other by a pulley 61 of insulating material with which they form a rotatable unit. The pulley is formed on its sides with axially extending cylindrical walls 62, 62 which enclose and form insulating casings for the magnets 58 and 59. Each magnet has an electrical winding 64 and as these windings rotate as a part of the magnets they are connected to the encircling contact rings 65, 65, in the case of magnet 58 and 66, 66 in the case of magnet 59. In contact with rings 65, 65 are wiper contacts 68, 68 and with rings 66, 66 contacts 69, 69; the wiper contacts being carried by the nozzle casing in such position as to be able to contact the magnet rings and being connected to an incoming current source. Each magnet is formed with a peripheral flange 71 which serves as a pole face and is covered on its radial side with a friction lining 72.

At one end of the pulley-magnet unit, and adjacent the pole face of magnet 59, is an eccentric 75 which is itself rotatably carried by a bearing sleeve 76 upon the stationary shaft 55. A seat at the end of reciprocating shaft 77 encircles the eccentric 75 which is rotatable therein, a bearing 78 being provided therebetween. The shaft 77 extends forwardly and through the rear wall of the nozzle by means of a flexible air-sealing sleeve 79 and, after making two right angles so that it extends parallel to the nozzle end wall connects through a pivot pin 80 to the upwardly extending end of the T frame 43 which carries one end of the beater elements 42, 42. Rotation of the eccentric 75 causes the arm 77 at its point of connection therewith to move in an orbit which has a horizontal translation equal to twice the eccentricity present in the eccentric. The forward end of the arm is translated horizontally to an equal extent and results in the pivotal movement of the attached frame 43 and the consequent vertical displacement of beater elements 42, 42 about their pivot points 44, 44.

Fixed to the eccentric 75 is a flexible disc 84 which is provided with a relatively heavy metallic rim element 85 extending immediately adjacent the friction lining 72 carried by the adjacent pole

face 71. Disc 84 normally extends in a radial plane about the stationary shaft 55 but upon the magnet 59 becoming energized by the passage of electric current through the coil 64 the rim element 85 is drawn to the peripheral rim or pole face 71 of the magnet until the friction material 72 is compressed between the two metallic elements and the eccentric is locked to the magnet and rotates therewith.

At the opposite end of the stationary shaft 55 from the eccentric 75 and spaced therefrom by a second supporting wall 90, is a pulley 91 rotatably mounted upon the shaft by a sleeve bearing 92 within the wall 90 by a bearing 93 so as to support both itself and the shaft 55. Pulley 91 carries a flexible disc member 94, similar to disc element 84 on the eccentric 75, and a metallic rim element 95 thereon is adapted to be drawn to the circular pole face 71 of the magnet 58 upon its coil 64 being energized, the friction material 72 being compressed therebetween. In this relationship the pulley 91 rotates with the pulley-magnet unit.

The supporting wall 90 for the shaft 55 forms a belt channel through being curved so that its forward extremities abut the rear wall of the nozzle proper. Above the rear lip 38 an opening 96 is provided connecting the channel to the nozzle so that a belt 97 may extend from the pulley 91 to the pulley of agitator 40 within the nozzle. A removable bottom plate 99 closes the bottom of the belt channel formed by the wall 90 as well as closing from the exterior the pulley unit aforedescribed.

An additional feature of interest is the switch by which the motor speed is automatically changed as the cleaner handle is pivoted to the vertical or storage position. Referring to Figures 7, 8 and 9 in particular the structure by which this result is obtained is disclosed.

A handle-position-controlled switch 101 having a switch casing 102 of insulating material is positioned upon the forward interior wall of the casing 10 adjacent the motor 13. Stationary contacts 103 and 104 within the switch housing are suitably connected by electrical conductors, as hereinafter explained, to the clutch magnets, and to one side of the field of the motor, respectively. Spring contacts 105 and 106 are adapted to contact the stationary contacts 103 and 104, respectively, in one position and are connected for conjoint movement by a bar 107 of insulating material. Bar 107 also carries a contact 108 which is so positioned as to contact a stationary contact 109 when spring contacts 105 and 106 are spaced from stationary contacts 103 and 104, respectively. Contact 109 is connected to a mid-point of the motor field, by suitable electrical conducting means while contact 108, together with spring contacts 105 and 106 is connected by a bus bar 110 to the incoming current-carrying lead 127.

Because of the natural resiliency of lead spring contacts 105 and 106 they are normally in contact with stationary contacts 103 and 104, respectively, and the insulating bar 107 is so held as to separate contacts 108 and 109. This is the normal relationship of the contacts in the on-the-floor cleaning relationship of the cleaner. Upon the conversion of the cleaner to an off-the-floor unit, however, it is desirable to increase the motor speed to effect greater suction and to remove from the electrical circuit the windings of the magnetic clutches. To accomplish this latter result, contact 105 must be moved from contact 103. To obtain greater suction the motor and fan must rotate at higher speed and this is effected by moving contact 106 from contact 104, the former being connected to the exterior of the motor field winding, and by bringing together contacts 108 and 109, the latter being connected to a mid-point of the field winding. This entire movement of contacts is accomplished by moving insulating bar 107 from contacts 103 and 104 and this is brought about upon the rotation of the casing 10 as the handle moves upwardly through the working range into the vertical position.

In Figure 8 the cleaner handle is shown in the horizontal position and an abutment element 112 carried by the movable contact-carrying bar 107 is seen to project outwardly through the casing 10. Upon the rotation of the motor casing as the handle movs upwardly from the horizontal position, illustrated in Figure 8, to the vertical position, illustrated in Figure 7, the abutment element 112 moves with the casing and is contacted by a cam abutment or boss 113 on the nozzle which is so contoured as to force the element 112 into the casing. The movement of abutment 112 is directly transmitted to bar 107 and results in the separation of elements 105 and 106 from contacts 103 and 104, and the bringing together of contacts 108 and 109. Part of the motor field is now disconnected, contacts 104 and 106 being open and the motor rotates at high speed, the clutch magnet windings being disconnected from the electric circuit of the machine by the opening of contacts 103 and 105.

In addition to the circuit control exercised by the handle-position-controlled switch 101, there is a manually operable clutch-controlling switch 115 positioned at the end of the cleaner handle. Having a three-way snap action, switch 115 comprises a rotatable insulating knob 116 on the sides of which appear the notations "Beater and brush," "Brush" and "Beater." A fixed arrow on the handle end adjacent the knob is aligned with one of the three markings in each of the various switch positions. A rotatable contact element 117, to which a current-carrying lead 121 connects is operated by the knob 116 through a shaft 118 and knob rotation produces, by any suitable mechanism, snap-action rotation of this element. Being a three position contact permits element 117 to connect its current-carrying lead 121 to either the lead 119, which causes current to pass through the winding 64 of beater clutch magnet 59, with lead 120, which causes current to pass through the winding 64 of brush clutch magnet 58, or with both leads 119 and 120 causing both magnets to be energized.

Aside from the headlight 30, which is suitably connected, the electrical circuit of the cleaner is completed by the manually operable switch 26 which is positioned adjacent the cord 25 at its point of attachment to the cleaner handle 21. Cord 25 includes leads 126 and 127 which are adapted to bring current into the machine and with the switch 26 in series with the power it controls at all times the flow of current.

Referring now to Figure 11 in particular the electrical circuit of this first embodiment of the invention is shown diagrammatically. The incoming current-conducting leads 126 and 127 are connected to the handle switch 26 and to the handle position controlled switch 101 respectively. From the contact 103 of switch 101 a lead 125 connects to the leads 119 and 120 which in

turn connect directly to windings 64, 64 of the beater clutch magnet 59 and the brush clutch magnet 58, respectively. From the contact 109 of switch 101 a lead 124 connects to the midpoint of the motor field winding while from the contact 104 a conductor 128 connects to the external connection of the same field winding. The opposite side of the motor is connected by lead 129 to the lead 121 which is positioned between the handle switch 26 and the handle position-controlled switch 115. As one side of the motor connects directly to the handle switch 26 which is itself connected to the incoming power lead 126 it is clear that current will at all times pass through the motor with the switch 26 closed and also that its speed will be relatively fast or slow depending upon whether handle-position-controlled switch 101 has placed only a part or all of the field winding in the motor circuit. Cooperating with handle-position-controlled switch 101 in controlling the current flow through the windings 64, 64 of magnets 58 and 59 is the three position snap action switch or clutch switch 115. Whereas switch 101 can connect or cut both clutch magnets into and from the electrical circuit, switch 115 is seen to be able to connect or disconnect the magnets jointly and severally.

The operation of the cleaner constructed in accordance with the present embodiment of the invention is as follows: In on-the-floor cleaning the conductor 25 is connected to a source of electricity and current passes into the machine. With the switch 26 closed current passes to the motor and to the switch 101 which is controlled by the angular position of the casing 10 and the handle 21. The handle being in the working range, as illustrated in Figure 8, the switch 101 assumes the relationship illustrated in Figure 9 and also diagrammatically in Figure 11. Current passes through the cleaner motor which rotates at low speed, the entire field winding being in the circuit. The current also passes from the switch 101 through the lead 125 to the windings 64, 64 of the magnetic clutches. Depending upon the position of the three-position clutch switch 115 the windings 64, 64 are in the electrical circuit, are omitted from that circuit, or are both connected therein. The selection of beating or brushing agitation for the cleaner in the on-the-floor cleaning relationship is accomplished simply by turning the switch 115 until the notation corresponding to the agitation desired is opposite the arrow on the handle. When the knob 116 is positioned so that the marking "Brush" is adjacent to the arrow on the handle current passes through the lead 120 to the coil 64 of the magnet 58. The magnetic flux created by the winding 64 causes the metallic rim element 95 to be drawn to the pole face 71 compressing the friction material 72 and connecting the pulley 91 to the rotating magnet 58. This movement is permitted by the flexible disc 94 which carries 95. The pulley 91 now rotates with the shaft 55 and the brush 40 is driven by the belt 97. The rotation of the pulley with the jack shaft 55 continues only as long as the magnet 58 is energized for upon the cessation of current flow through its winding 64 the flexible disc 94 flexes back to its normal radial position.

If the operator desires that the beater element alone agitate the surface covering undergoing cleaning, he positions the knob 116 so that the marking "Beater" is adjacent the handle arrow in which relationship the magnet 59 only is energized. The metallic rim 85 is drawn to the pole face 71, the disc 84 flexing exactly in the manner of disc 94 and rim 95 of the brush clutch. The eccentric 75 now rotates resulting in the movement of the arm 77 and the pivotal movement of the beating element frames 43, 43 and the vertical reciprocation of the beating elements 42, 42.

Both brushing and beating elements can be actuated simultaneously by positioning the knob 116 so that the marking "Beater and brush" are positioned adjacent the arrow, in which case both energized clutches are closed. The magnets 58 and 59 are both energized and the brush pulley 91 as well as the agitator eccentric 75 rotate with the jack shaft 55.

If the operator desires to convert the cleaner into an off-the-floor cleaning machine so that dusting tools can be used therewith, he pivots the handle to the vertical position illustrated in Figure 7. The contact of the abutment element 112 with the cammed boss 113 as the casing 10 rotated resulted in the movement of contacts 105, 106 and 108 of the switch 101 so that the coils 64, 64 of the magnets 58 and 59 are now completely omitted from the circuit regardless of the position of manual clutch switch 115. Fixed contact 104 which connects to the end of the motor field by lead 128 is now separated from the movable contact 106 and instead contact 109, connected by lead 124 to the field midpoint, has been contacted by contact 108 and only part of the field winding is in the motor circuit. The motor now rotates at high speed and the agitators are declutched and inactive. Upon the removal of the cover plate 19 from the air passageway 2 a dusting tool converter member 132, with attached flexible hose 133, can be connected to the fan chamber and so to the suction created by the rotating fan 14. Operation of the cleaner motor can at all times be controlled by the hand switch 26 whether the cleaner is used in on-the-floor cleaning or off-the-floor cleaning. Re-conversion of the machine to an on-the-floor cleaner is obtained simply by the removal of the converter member, the replacement of the cover element 19, and the movement of the handle to the operating range or to the horizontal position.

Referring now to Figures 12 and 13, in particular, the second preferred embodiment of the electrical clutch mechanisms and the wiring diagram therefor are disclosed. In this embodiment, as distinguished from the clutch mechanisms of the first embodiment, the clutch magnets do not rotate at all times but are instead fixed. The wiper contacts necessary to the first embodiment are accordingly eliminated in this construction.

Referring to Figure 12, in particular, the structure there shown is adapted to be substituted in Figure 1 for the clutch mechanism there disclosed with but slight modification. The belt pulley 150 is keyed to the jack shaft 151 which in the present embodiment is rotatably mounted at one end in a bearing sleeve 152 carried by the supporting wall 56. Clutch magnets 154 and 155 are fixedly secured to the casing 1 by screws 156, 156 etc. and are centrally counterbored to carry sleeve bearings 157, 157 for the shaft 151 which are aligned with bearing 152. Magnets 154 and 155 are provided with axially extending peripheral rims 158, 158 which act as pole faces, there being windings 159, 159.

Spaced from the sides of the magnets 154 and 155, respectively, are clutch plates 162 and

163 which are keyed to the shaft 151 and which always rotate therewith. Each clutch plate is provided with a friction lining 164.

Between the clutch plate 162 and magnet 154 is an eccentric 166 which is rotatably and slidably mounted upon shaft 151 by its bearing sleeve 167. The reciprocating shaft 77, described in the first embodiment, seats rotatably upon the eccentric by means of the bearing sleeve 78. Eccentric 166 is provided with radially extending side walls which appose the clutch plate 162 and the peripheral pole face 158 of the magnet 154 and its permitted axial movement allows it to contact either the clutch plate or the pole face.

Between the clutch plate 163 and the magnet 155 is positioned the rotatable pulley 170 rotatably and slidably mounted upon shaft 151 by a bearing sleeve 171. Pulley 170, in a manner similar to eccentric 166, is provided with side walls which appose the clutch plate 163 and the pole face 158 of magnet 155. Within the permissible axial movement of the pulley 170 it is adapted to contact on one side the clutch plate 163 and upon the other side the pole face 158.

Within a counterbore in magnets 154 and 155 is positioned a coil spring 173 which in each case seats upon the magnet to exert an outwardly directed axial thrust upon the adjacent pulley or eccentric, a ball bearing 174 being positioned adjacent the end of the spring in each case to permit of relative movement with a minimum of friction. Normally the springs 173, 173 force the pulley 170 and the eccentric 166 against the rotating shaft-carried clutch plates 162 and 163 respectively so that normally, in the absence of any magnetic pull exerted by the magnets 154 and 155, the pulley and the eccentric rotate with the shaft 151. The passage of current through the coils 159, 159 of the magnets functions to draw the eccentric and the pulley against the adjacent magnet face to declutch them from the shaft permitting them to stand idle while the shaft rotates. Both magnets may be energized or they may be energized separately, the electrical circuit to accomplish this result being disclosed in Figure 13.

Referring to Figure 13, in particular, the electrical circuit of the second embodiment of the invention is diagrammatically illustrated and is seen to be basically the same as the circuit for the first embodiment illustrated in Figure 11, but with certain modifications. In the present embodiment it is necessary that the magnets be energized to render the brush and the beater inoperative, whereas in the first embodiment with the magnets energized, the brush and beater do operate. Accordingly, in the circuit of the present embodiment the lead 125 connected to the windings 159, 159 of magnets 154 and 155 is connected around the handle-position-operated switch 101 and directly to the incoming current-carrying lead 127. The second feature by which the present circuit distinguishes from the first embodiment is in the provision of a second handle-position-controlled switch 175 which moves in synchronism with handle switch 101 of the first embodiment. Upon the movement of the cleaner handle and the rotation of the motor casing 10, switch 101 moves to cause the motor to operate at high speed through the omission of a part of the field winding as described in connection with the first embodiment. Upon this same movement switch 175 interconnects lead 176 which is connected directly to the handle switch 26 with leads 177 and 178 which themselves connect directly to leads 120 and 119 and so with the windings 159, 159 of magnets 155 and 154 controlling the brush and beater operation, respectively. As switch 101 moves into the high speed position, switch 175 directly connects the magnet windings to the incoming line regardless of the position of the manually operable clutch switch 115. The switch 175 functions then to short from the circuits of the two magnet windings 159, 159 the control switch 115 and establishes a current connection which will at all times pass through the magnet windings when the cleaner motor is operating at high speed thereby declutching both the brush and the beater element.

The operation of the second embodiment of the invention is substantially identical with the first embodiment from the standpoint of the observer. The entire machine can be connected to or disconnected from the circuit by the closing or opening of handle switch 26. In the on-the-floor cleaning with the cleaner handle in the operating or horizontal position the cleaner can be operated with the beater alone, with the brush alone, or with the brush and beater at the operator's election depending upon the position of the three position clutch switch 115. Both the brush-driving pulley 170 and the beater-driving eccentric 166 are spring-held by springs 173, 173 against clutch plates 162, 163 which at all times rotate with the jack shaft and it is only when the controlling magnet for the pulley or the eccentric is energized that that element is declutched from the rotating jack shaft. With the handle moved to the vertical or storage position the motor speed is immediately increased and the three position switch 115 is shorted from the circuit and both magnets are energized to declutch the beater and the brush during off-the-floor cleaning. The structural features of the machine except as described immediately above are identical with the first embodiment.

Referring now to Figures 14 to 17, inclusive, the third preferred embodiment of the invention is disclosed. This embodiment differs primarily from the preceding embodiments in that the magnetically operated clutches are positioned entirely within the nozzle proper instead in the rear thereof. A jack shaft is again provided in this embodiment but its function is solely to permit the belt to be connected at the most desirable point to the agitator, and also to seal completely the motor from the dirt-laden air within the cleaner nozzle. The construction is also fundamentally different in that the reciprocating shaft between the jack shaft and the agitator has been eliminated so that only a belt extends into the nozzle proper, the reciprocation of the beater elements being obtained by the provision of a rotatable eccentric upon the agitator shaft.

In the present embodiment the nozzle casing 1 and its attendant construction as well as the main casing 10 and its connected parts, are as disclosed in the preceding embodiments. In this instance, however, a jack shaft 185, located similarly to the jack shafts of the preceding embodiments, extends between the passage 3 and a belt tunnel near the side of the casing 1 formed by wall 186, being rotatably supported between the passageway and the tunnel by ball bearings 187, 187. Jack shaft 185 is provided with pulleys upon its ends, pulley 188 seating the belt 35 from the motor shaft pulley 34, while pulley 189

carries belt 97 which extends forwardly into the nozzle proper.

Agitator 190 is positioned within the nozzle mouth, where it is adapted to contact the surface covering undergoing cleaning between the nozzle lips 37 and 38, comprises an elongated hollow cylindrical body with one flat end and within which are removably seated brush elements 191, 191 etc. A through-supporting shaft 192 rotatably and slidably supports the agitator body by means of sleeve bearings 193, 193, the shaft 192 itself being carried by the nozzle through having its end seated in central counterbores of clutch magnets 194 and 195. These last include laterally extending shoulder elements 197, 197 through which screws 198, 198 extend to secure the entire construction to downwardly projecting supports 199, 199 from the top of the nozzle.

At one end of the rotary agitator 190, positioned so as to receive the power-transmitting belt 97, is the rotatable pulley 202 which is carried by the shaft in fixed axial position by a ball bearing support 203. The side faces of pulley 202 extend in radial planes and are lined with a friction lining 204.

Between the pulley 202 and the magnet 194 at the end of the nozzle is an eccentric 207 which is rotatably and slidably mounted upon the shaft 192 by a sleeve bearing 208. Eccentric 207 is provided with radial side walls of enlarged diameter which extend adjacent to the magnet 194 upon one side and upon the other side to the friction-lined face of pulley 202. A coil spring 210 within the counterbore of magnet 194 at all times urges the eccentric 207 toward the pulley face, a thrust bearing 211 being interposed between the spring and the eccentric to reduce friction.

At the opposite end of the nozzle the magnet 195 supports the end of shaft 192 and is counterbored to seat the spring 210 which at all times urges the agitator 190 axially upon the shaft so that its flat end plate contacts the lined face of pulley 202. In this case also a thrust bearing 211 minimizes the frictional losses. With both magnets de-energized the springs 210, 210 at the ends of the nozzle force the agitator 190 and the eccentric 207 into contact with the driven pulley 202 so that both rotate therewith.

In the present embodiment the vertically reciprocating beater elements 42, 42 are again carried by end plates 43, 43 which are themselves rotatably mounted by pins 214, 214 in suitable bearings 215, 215 carried by the magnets 194 and 195 at the nozzle ends. Pins 214, 214 are located below and in vertical alignment with the agitator shaft 192, and the relationship is such that the pins may slide slightly into and out of their bearing seats to permit the assembly to be moved longitudinally of the nozzle within narrow limits. At the one end of the nozzle adjacent the magnet 194 the end plate 43 is provided with upwardly projecting arms 217, 217 which enclose and seat the eccentric 207 in such relationship that the rotation of the eccentric causes the arms 217, 217 to be moved to pivot the entire assembly about the supporting pins 214, 214 and to cause the beater elements 42, 42 to reciprocate to beat a surface covering undergoing cleaning.

As in the previous embodiments each magnet at the nozzle end is provided with an electrical winding, here indicated by the reference characters 219, 219. Current is conducted to these windings of the magnets, which are themselves removable through the nozzle mouth upon the removal of the screws 198, 198, by upwardly extending knife blade contacts 220, 220 which seat within female contact members 221, 221 carried by blocks 222, 222 of insulating material at the tops of the nozzle ends.

The electrical circuit of this third embodiment of the invention is shown by Figure 13 and is identical with the second embodiment. In this case, as in that case, the beaters and the brush are disconnected from the driving source when the magnets are energized. When the magnets are de-energized the spring elements 210, 210 hold the agitator and the beater-driving eccentric 207 in contact with the driving pulley 202 in the nozzle. Upon closing the switch to energize magnet 194 the eccentric is drawn thereto compressing as it does so the spring 210. When in contact with the magnet the opposite flat face of the eccentric is spaced from the pulley 202 and is not driven thereby. De-energizing the magnet permits the spring 210 to slide the eccentric, together with the beater bars 42, 42 and their connecting end plates which are all attached thereto by the arms 217, 217 of the one end plate 43, axially, the pivot pins 214, 214 sliding in their bearings 215, 215. Upon closing the switch to energize magnet 195 the agitator 190 is drawn axially on the shaft 192 against the force exerted by its spring 210 and from contact with the driving pulley 202. De-energizing the magnet permits the spring to force the agitator back into contact with the pulley.

The selective control of beaters and brushes by the three-position switch upon the handle is as taught in the previous embodiment and the conversion of the motor to its high speed relationship is automatic with the movement of the handle to the vertical storage position for dusting tool use as in the preceding embodiment. The present embodiment differs materially from the preceding embodiment through providing the entire agitating and declutching mechanism within the nozzle from which it is readily removable upon the removal of four screws 198, there being two such screws at each end of the nozzle which retain the magnets 194 and 195 in place. Their removal permits of the downward displacement through the nozzle mouth of the magnets and the agitating assembly which they support. Such displacement is accompanied by the separation of the knife blade contacts 220 from their seats 221 in each case. Replacement is in an obvious manner.

I claim:

1. In a suction cleaner, a casing, suction-creating means in said casing, a driving motor connected to said means, a surface-brushing means, a surface-beating means, power transmission means connecting said brushing and beating means to said motor, and manually operable means operable from the exterior of said casing to connect and disconnect said brushing and beating means selectively and independently to said motor.

2. In a suction cleaner, a body, a single electric motor, a beater and a brush in said body, and means operable exteriorly of said body to operate selectively or conjointly said beater and brush from said motor.

3. In a suction cleaner, a body, an electrically driven power source, a beater, a brush, power transmission means between said power source and said beater and brush, said beater, brush and transmission means being in said body, elec-

trically operated clutches to connect and disconnect selectively said brush or beater from said power source also positioned in said body, and manually operable means exterior of said body to operate said clutches.

4. In a suction cleaner, a motor, a rotary brush, a reciprocating agitator, electrically operated clutch means between said motor and said brush and agitator, and single switch means to connect selectively said brush or agitator to said motor.

5. In a suction cleaner a driving motor, an element driven by said motor, a fan driven by said motor, a rotary agitator driven by said element, a reciprocating agitator driven by said element, and clutch means carried by said element to selectively connect said rotary or said reciprocating agitator to said shaft.

6. In a suction cleaner, a driving motor, a rotatable element driven by said motor, a reciprocating agitator driven by said element, a rotary agitator driven by said element, clutch means on said element including electrical magnets rotatable therewith to connect or disconnect selectively said agitators from said element or to connect both agitators thereto, and manually operable control means to energize or de-energize said magnets.

7. In a suction cleaner, a driving motor, a shaft driven by said motor, an eccentric freely rotatable on said shaft, a pulley freely rotatable on said shaft, a reciprocatory agitator connected to said eccentric, a rotary agitator connected to said pulley, and clutch means comprising electrical solenoids so mounted and arranged as to clutch and declutch said eccentric and said pulley to the shaft, and manually operable means to control the flow of current through said solenoids to clutch or declutch selectively said reciprocatory or said rotary agitator to said shaft.

8. In a suction cleaner, a driving motor, a shaft, a pulley-magnet unit rotatable on said shaft and driven by said motor, an eccentric freely rotatable on said shaft and adapted to be connected to said unit when the latter is energized, resilient means opposing the connection of said eccentric and unit, a reciprocating agitator connected to said eccentric, a pulley freely rotatable upon said shaft and adapted to be connected to said unit when the latter is energized, resilient means opposing the connection of said pulley and unit, a rotary agitator connected to said pulley, and manually operable means to control the flow of current to said unit.

9. In a suction cleaner, a driven shaft, a pulley freely rotatable on said shaft, means normally connecting said pulley to said shaft for rotation therewith, a non-rotating electrical magnet so mounted and arranged as to disengage said last mentioned means when energized, an eccentric freely rotatable on said shaft, means normally connecting said eccentric to said shaft for rotation therewith, a non-rotating electrical magnet so mounted and arranged as to disengage said last mentioned means when energized, and switch means to control said magnets.

10. In a suction cleaner, a nozzle, a driven rotary member in said nozzle, a rotary agitator in said nozzle, a reciprocating agitator in said nozzle, means to connect selectively said agitators to said driven rotary member, electrically operated means to disconnect said agitators from said driven member and manually operable control means for said connecting means positioned exteriorly of said nozzle.

11. In a suction cleaner, a driven member, a rotary agitator slidable into engagement with said member to rotate therewith, means to maintain such engagement, a reciprocatory agitator slidable into engagement with said member to be actuated thereby, means to maintain said last-mentioned engagement electrically actuated means to move said agitators from engagement with said member, and manually operable control means controlling said electrically actuated means.

12. In a suction cleaner adapted for on-the-floor and off-the-floor cleaning, suction-creating means including a multi-speed multi-circuit electric motor, a handle, a surface agitator, means to connect and disconnect said agitator to said motor including electrically operated means, and switch means operated by movement of said handle to change the electrical circuit of said motor to increase its speed and to control the circuit through said electrically operated means to disconnect said agitator with said handle in the vertical position.

13. In a suction cleaner a driving motor, a shaft rotated by said motor, a pair of clutch surfaces rotatable with said shaft, means to drive said brush adapted to be clutched to one of said clutch surfaces, means to drive a beater adapted to be clutched to a second clutch surface, means normally urging said beater and brush driving means into clutched relationship with said clutch surfaces, and electrically operated means selectively to overcome said last mentioned means to declutch said beater and brush driving means.

14. In a suction cleaner a driving motor, a shaft rotated by said motor, a pair of clutch surfaces rotatable with said shaft, a pulley on said shaft including clutch means to cooperate with one of said clutch surfaces, an eccentric on said shaft including clutch means to cooperate with a second clutch surface, agitating means connected to said pulley and eccentric to be actuated thereby, and means including electrically operated manually controlled means to clutch and to declutch said pulley and said agitator to and from said shaft.

DONALD G. SMELLIE.